FARMSCAPING: IPM TOOL IN ORGANIC VEGETABLE PRODUCTION

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INTRODUCTION

Farmscaping is a "whole-farm, ecological approach to pest management" and "can be defined as the use of hedgerows, insectary plants, cover crops, and water reservoirs to attract and support populations of beneficial organisms such as insects, bats, and birds of prey" (Dufour, 2000). The primary goal of farmscaping is to prevent economic damage on crops by pests by providing favorable habitat to beneficial species. Farmscaping employs all tools and strategies of crop and habitat manipulations to provide refugia, food and water sources, and create favorable microclimate to natural enemies and pollinators. With farmscaping, pesticide use is reduced, operational cost minimized, crop yield increased and worker safety improved.

In preparing a farmscaping plan, take into account individual components, their interrelationship and interaction, how environmental factors (soil, temperature, rainfall, photoperiod) affect plants and fauna, and how these influences impact farm productivity and sustainability. A schematic overview of these interactions is presented in Figure 1. The outside circle (light green background) represents environmental factors (i.e., soil, temperature, rainfall, photoperiod). Because farmscaping involves biointensive and low-risk pest management input, it is highly compatible with organic farming.

This paper identifies pest and beneficial arthropods attracted to insectary plants established at AAMU's Winfred Thomas Agricultural Research Station located (WTARS) in Hazel Green, AL (N 34.9025, W 86.5596) in 2008-12, and compares the responses of carabid beetle populations to cover crops .

OBJECTIVES

1. To establish baseline data on foraging insect fauna on insectary plants under study
2. To determine the influence of cover crops on carabid beetle populations

GENERAL METHODOLOGY

Insectary plant species

Insectary plants were selected primarily according to their adaptation to southern climate and to their availability. Insectary plants were established in plots adjacent to vegetable plantings . Observations were made mainly on foraging insect species. Because the density and number of species of insectary plants assessed varied between years, except to identify insect foragers, there was no attempt made to quantify and statistically analyze collected data.

Insectary plants (Figures 2-4) previously evaluated were Spider plant (*Cleome hassleriana*; Cleomaceae), Mexican sunflower (*Tithonia rotundifolia*; Asteraceae), Calendula (*Calendula officinalis*; Asteraceae), Queen Anne's lace (*Daucus carota*; Apiaceae), Cosmos (*Cosmos bipinnatus*; Asteraceae), Black-eyed Susan [*Rudbeckia hirta*; Asteraceae), Yarrow (*Achillea millifolium*; Asteraceae), Sweet alyssum (*Lobularia maritime* (Brassicaceae), Basil (*Ocimum basilicum*; Lamiaceae), Fennel (*Foeniculum vulgare*; Apiaceae) and Blue anise sage (*Salvia guaranitica*; Lamiaceae). Current stand of farmscaping plants at WTARS include cosmos, Mexican sunflower, sunflower [*Helianthus annuus* (Asteraceae)], scarlet sage [*Salvia splendens* (Lamiaceae)], blue anise sage, verbena [*Verbena sp.* (Verbenaceae)], coleus [*Coleus sp.* (Lamiaceae)], lantana [*Lantana camara* (Verbenaceae)], vinca [*Vinca sp.* (Apocynaceae)], and buckwheat [*Fagopyrum esculentum* (Polygonaceae)] . Although most test plants are annuals, they produce large number of seeds that grow the following season. Other flowering plants particularly those that bloom during fall season as well as naturally occurring grasses and weeds will be added to the list.

Carabid beetle populations were monitored for 8 weeks in June –July 2008 in plots previously planted to cover crops [Austrian sweet pea (*Lathyrus hirsutus* ;Fabaceae), ryegrass (*Lolium perenne;* Poaceae), crimson clover (*Trifolium hirsutum*; Fabaceae) and hairy vetch (*Vicia villosa*; Fabaceae)]. Weekly insect sampling was done by pitfall traps.

RESULTS

Mexican sunflower (*T. rotundifolia*) and other species in the family Asteraceae supported diverse pest and beneficial insect communities. ***Tithonia*** was an

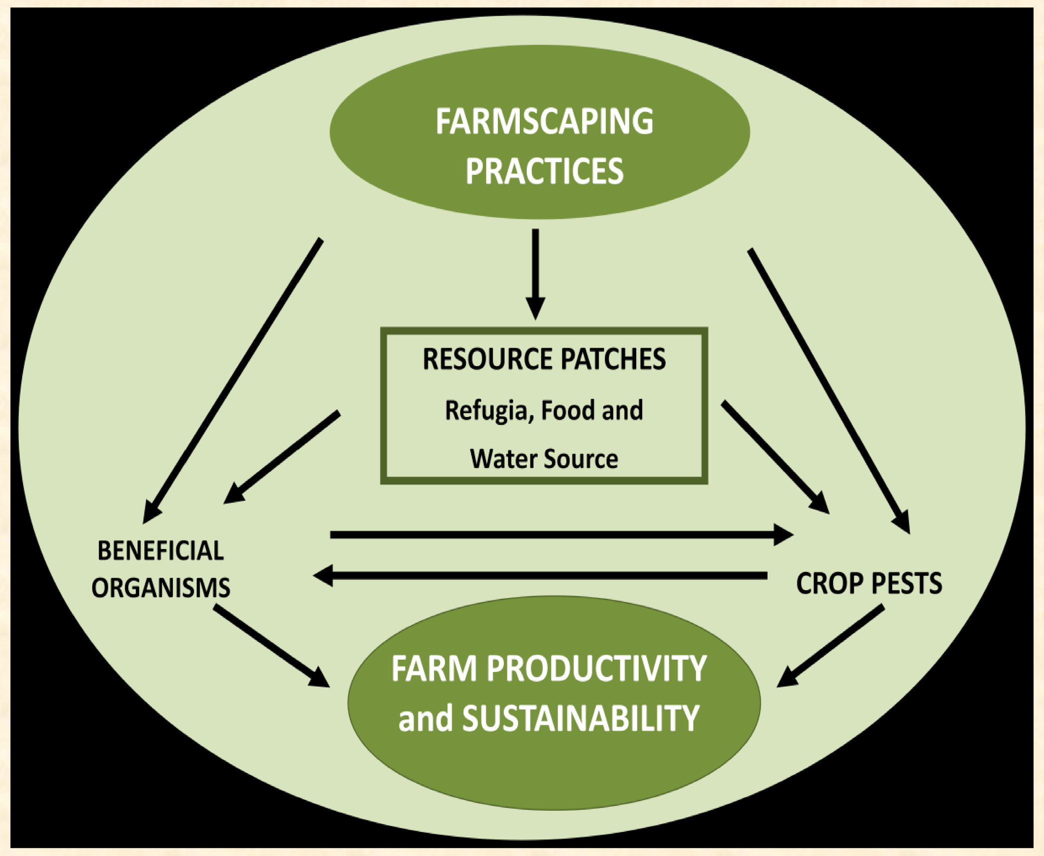

Figure 1. Dynamic interactions among farming system components (schematic overview).

Figure 2. Some insect species supported by Mexican sunflower (*Tithonia rotundifolia*) .

Figure 4. Basil attracts numerous insect species.

Figure 3. Spider plant (*Cleome hassleriana),* an excellent trap crop for harlequin bug (*Murgantia histrionica*).

Figure 5. Crimson clover, ryegrass and hairy vetch

Figure 6. Pitfall trap

Figure 7. Carabid beetles

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RESULTS (Cont'd.)

an excellent food source for both insect pests and beneficial species. Among those commonly observed were several moths (corn earworm, dagger moth, ailanthus webworm, bird drop moth), butterflies (gulf fritillary, Sachem skippers, common checkered skipper, cabbage butterflies, orange sulfurs, lycaenids, swallow tails, red spotted purple, common buckeye), lacewings, tarnished plant bug, aphid, whiteflies, wasps (paper wasps, sphecids), bees (honey bees, bumble bees, halictids, carpenter bees), beetles (long-horned beetles, soldier, meloid and ladybird beetles), grasshoppers, damsel bug, big-eyed bug, minute pirate bug, syrphid flies and spiders. Tarnished plant bug and corn earworm larvae devastated ***Calendula*** blooms*.* Most of the insects found on Mexican sunflower and **Cosmos** visited **Basil** particularly at flowering stage; equally large numbers of species foraged on basil. Several varieties of basil grown at WTARS attract foliage feeders (grasshoppers, aphids, lygus bug, meloid beetles) and pollen and nectar foragers (butterflies, moths, bees and beetles, and flies). Damsel bugs, lacewings, big-eyed bug and minute pirate bug, and numerous solitary and predatory wasps were also observed foraging on basil nectaries. **Spider plant/Cleome** *(C. hassleriana)*, an unidentified webworm bored into the stem and spun sticktight web . Fresh frass outside the feeding site marks the presence of the webworms. *Cleome* was also heavily infested by *Murgantia histrionica* (harlequin bug). In 2012, 2,023 harlequin bugs were collected by shaking five spider plants into plastic bags (ca. 406 mixed adults and nymphs/plant). Adult and immature stages of this pest suck plant juices. Feeding damage on leaves is manifested by whitish to brown lesions that coalesce into large brown patches making the leaves appear burnt. However, severely damaged plants were still able to recover later in the season. Thus, *Cleome* makes an excellent trap crop for harlequin bug. *Cleome* produces so much seeds that removal (thinning) of volunteer seedlings may pose a problem the following season. Another important insectary plant is **Queen Anne's lace**. Wild patches of this plant occur naturally at WTARS. Numerous arthropods forage on the flowers. Those observed include spiders, tarnished plant bug, minute pirate bug, big-eyed bug, lace wings. A complement of insectary plant species that can provide shelter and food sources year round is an important consideration when designing a farmscaping plan.

CARABID BEETLES are ubiquitous and have been used as bioindicators in several ecological studies. This study was conducted to determine variation in carabid communities in response to cover crops (Figures 5-7). Results are presented below.

A. Crimson clover: 10 species (42 individuals)
Agonum octopunctatum(1), Amara sp.(1), Anisodactylus furvus (1), Anisodactylus dolcicolli (2), Anisodactylus spp.(4), Cicindela punctulata (1) *Harpalus pennsylvanicus(29)*, *Megacephala virginicana (1), Pterostichus sp (1), Scarites quadriceps (1)*,

B. Rye grass: 10 species (29 individuals)
Agonum punctiforme (1), A. furvus (2), A. dolcicollis (1), Anisodactylus spp. (1), Amara sp. (1), Carabus sp. (1), C. punctulata (2), H. pennsylvanicus (17), *M. virginicana (2), Selenophorus sp. (1)*

C. Hairy vetch: 6 species (36 individuals)
A. furvus (1), Anisodactylus spp. (6), C. punctulata (2)
H. pennsylvanicus (25), *Poecilus chalcites (1)*, *S. quadriceps (1)*

D. Austrian pea: 7 species (56 individuals)
A. dolcicollis (5), Anisodactylus spp. (5), Carabus sp. (1), C. punctulata (2),
H. pennsylvanicus (41), P. chalcites (1), S. quadriceps (1)

E. Fallow (Control) : 8 species (38 individuals)
A. punctiforme (1), Amara sp. (3), A. furvus (2), Anisodactylus spp. (6), H. pennsylvanicus (21), M. virginicana (1), Megacephala carolina (1), *S. quadriceps (3)*

Crimson clover and rye grass yielded the most number of species but rye grass had fewer individuals recruited. Austrian winter pea yielded the highest number of carabid beetles. Among species collected, . *H. pennsylvanicus* was most abundant in all plots sampled including area under fallow.
For this reason, other carabid species might be better bioindicator than *H. pennsylvanicus.*